India's International Trade of Four Specific Commodities in the Recent Past

Some Insights

Preface

The study uses trade indicators to analyse merchandise export and import data in a way that should be useful for the purpose of policy. The indicators provide a glimpse of the trade patterns of the world and the performance of India in comparison to various other countries. They have been used in the case of India's exports of **Quartz (Other than Natural Sand) & Maize (Corn)** and imports of **Nitrile-Function Compound and Glass Fibre (including glass wool)** to indicate the possible directions policy may take.

The data used in this study has been sourced from the Export Import Data Bank of the DGCI&S, Department of Commerce, and Government of India and from the United Nations Comtrade Database. Introduction notes of each commodities has been sourced from the various sights –viz Wikipedia, Britannica, The Economic Times etc.

Computations are based on data at ITC-HS four-digit level (ITC-HS Code-2506 & 1005 for export and 2926 & 7019 for import) and the latest finalized data available on the UN Comtrade Database up to year 2021 and on the DGCI&S Database up to February'2023. So, trends from 2019 to 2022 have been shown when we extract the data from UN Comtrade and from 2018 to 2021 have been shown when we extract the data from DGCIS Data base.

In this report, we will see various analysis and aspects of India's Precious as well as International export trade of Quartz (Other than Natural Sand) & Maize (Corn) and imports of Nitrile-Function Compound and Glass Fibre (including glass wool). We will use both the 4 digit Commodity codes.

Trends in India's as well as International Trade i.e. Exports and Imports of above four Commodities are given below in different tables :

- Table 1 : India's top 10 Export destination of Quartz with their shares in percentage.
- Table 2 : World's top 10 Exporters of Quartz with their shares in percentage.
- Table 3 : World's top 10 Importers of Quartz with their shares in percentage.
- Annex- I : Top 3 sources of Quartz of World's top 3 Importers.
- Table 4 : India's top 10 destination of Maize (Corn) with their shares in percentage.
- Table5 : World's top 10 Exporters of Maize (Corn) with their shares in percentage.
- Table 6 : World's top 10 Importers of Maize (Corn) with their shares in percentage.
- Annex-II : Top 3 sources of Maize (Corn) of World's top 3 Importers.
- Table 7 : India's top10 Sources of Nitrile-Function Compound with their shares in percentage.
- Tablev8:World's top 10 Importers of Nitrile-Function Compound with their shares in percentage.
- Table 9 : India's top 10 Sources of Glass Fibre (including glass wool) with their shares in percentage.
- Table 10 : World's top 10 Importers of Glass Fibre (including glass wool) with their shares in percentage.

EXPORT

Quartz (Other than Natural Sand)

Quartz, widely distributed mineral of many varieties that consists primarily of silica, or silicon dioxide (SiO_2). Minor impurities such as lithium, sodium, potassium, and titanium may be present. Quartz has attracted attention from the earliest times; water-clear crystals were known to the ancient Greeks as *krystallos*—hence the name *crystal*, or more commonly *rock crystal*, applied to this variety. The name *quartz* is an old German word of uncertain origin first used by Georgius Agricola in 1530.

Quartz has great economic importance. Many varieties are gemstones, including amethyst, citrine, smoky quartz, and rose quartz. Sandstone, composed mainly of quartz, is an important building stone. Large amounts of quartz sand (also known as silica sand) are used in the manufacture of glass and ceramics and for foundry moulds in metal casting. Crushed quartz is used as an abrasive in sandpaper, silica sand is employed in sandblasting, and sandstone is still used whole to make whetstones, millstones, and grindstones. Silica glass (also called fused quartz) is used in optics to transmit ultraviolet light. Tubing and various vessels of fused quartz have important laboratory applications, and quartz fibres are employed in extremely sensitive weighing devices.

Quartz is the second most abundant mineral in Earth's crust after feldspar. It occurs in nearly all acid igneous, metamorphic, and sedimentary rocks. It is an essential mineral in such silica-rich felsic rocks as granites, granodiorites, and rhyolites. It is highly resistant to weathering and tends to concentrate in sandstones and other detrital rocks. Secondary quartz serves as a cement in sedimentary rocks of this kind, forming overgrowths on detrital grains. Microcrystalline varieties of silica known as chert, flint, agate, and jasper consist of a fine network of quartz. Metamorphism of quartz-bearing igneous and sedimentary rocks typically increases the amount of quartz and its grain size.

Quartz is piezoelectric: a crystal develops positive and negative charges on alternate prism edges when it is subjected to pressure or tension. The charges are proportional to the change in pressure. Because of its piezoelectric property, a quartz plate can be used as a pressure gauge, as in depth-sounding apparatus.

Just as compression and tension produce opposite charges, the converse effect is that alternating opposite charges will cause alternating expansion and contraction. A section cut from a quartz crystal with definite orientation and dimensions has a natural frequency of this expansion and contraction (i.e., vibration) that is very high, measured in millions of vibrations per second. Properly cut plates of quartz are used for frequency control in radios, televisions, and other electronic communications equipment and for crystal-controlled clocks and watches.

China, Japan, and India are the world's primary producers of quartz. Belgium, Brazil, Bulgaria, France, Germany, South Africa, and the United Kingdom also mine significant quantities of the mineral.

These are broadly classified under **H.S. Code-2506.**

Table - 1

India's Top 10 destination of Quartz (Other than natural Sand) (H.S Code-2506)

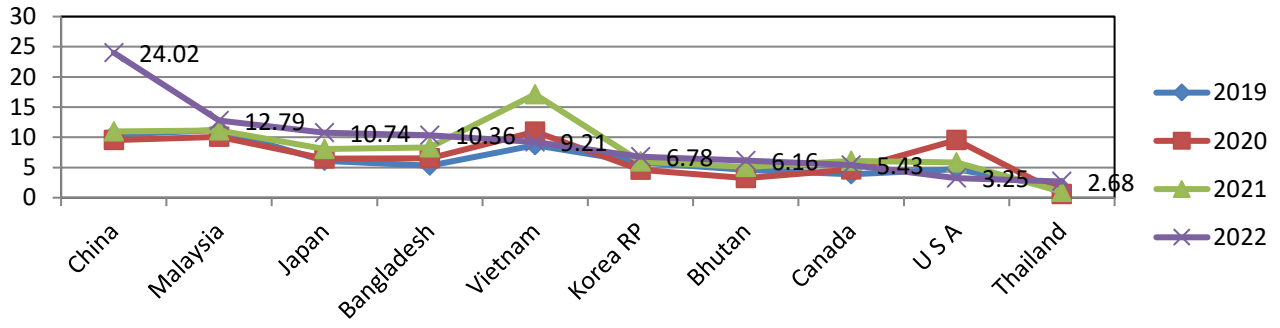
Rank	Countries	2019		2020		2021		2022	
		Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	China	10.45	12.77	9.54	11.39	10.96	11.29	24.02	22.51
2.	Malaysia	11.21	13.70	10.10	12.05	11.15	11.48	12.79	11.99
3.	Japan	6.09	7.44	6.45	7.70	8.05	8.29	10.74	10.07
4.	Bangladesh	5.31	6.49	6.50	7.75	8.34	8.59	10.36	9.71
5.	Vietnam	8.68	10.61	10.93	13.04	17.12	17.63	9.21	8.64
6.	Korea RP	5.84	7.14	4.59	5.48	5.97	6.15	6.78	6.35
7.	Bhutan	4.62	5.64	3.26	3.89	5.09	5.24	6.16	5.77
8.	Canada	3.88	4.74	4.66	5.56	6.12	6.31	5.43	5.09
9.	U S A	4.71	5.75	9.57	11.41	5.81	5.99	3.25	3.05
10.	Thailand	1.59	1.94	0.59	0.70	0.98	1.01	2.68	2.51
	Others	19.46	23.78	17.61	21.02	17.48	18.00	15.26	14.30
	Total	81.85	100	83.80	100	97.07	100	106.68	100

Source: DGCI&S.

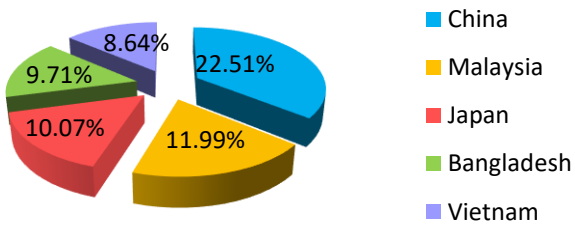
Note : India's Export including re-export

India's top destinations of Quart (other than natural sand) from 2019-2022**(in million USD)**

Data label given on the basis of 2022



India's top 5 destinations of Quart (other than natural sand) by percentage India in 2022:



The value of exports of Quartz (other than natural sand) from India totalled US $ 106.68 million in 2022 which was 9.90%, increased by in value terms compared to 2021. China, Malaysia and Japan were three major destination of Quartz (other than natural sand) from India with 22.51%, 11.99% and 10.07% share of India' total export in 2022 respectively. India's export of Quartz (other than naturasand) is hit for all time high of US $ 106.68 million in 2022.

Table-2

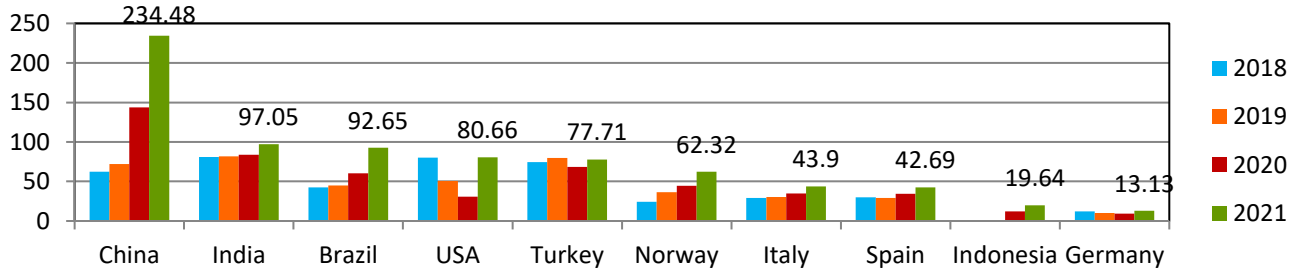
World's Top 10 exporter of Quart (other than natural sand) (H.S Code-2506)

Rank	Countries	2018		2019		2020		2021	
		Value (million $)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	China	62.54	11.69	72.03	13.42	143.74	23.76	234.48	27.56
2.	**India**	**81.09**	**15.16**	**81.70**	**15.22**	**83.73**	**13.84**	**97.05**	**11.41**
3.	Brazil	42.31	7.91	45.06	8.40	60.44	9.99	92.65	10.89
4.	USA	79.99	14.96	50.77	9.46	30.84	5.10	80.66	9.48
5.	Turkey	74.40	13.91	79.93	14.89	68.23	11.28	77.71	9.13
6.	Norway	24.30	4.54	36.32	6.77	44.35	7.33	62.32	7.33
7.	Italy	29.27	5.47	30.24	5.63	34.90	5.77	43.90	5.16
8.	Spain	30.01	5.61	29.06	5.42	34.44	5.69	42.69	5.02
9.	Indonesia	0.00	0.00	0.00	0.00	12.15	2.01	19.64	2.31
10.	Germany	12.00	2.24	10.19	1.90	9.20	1.52	13.13	1.54
	Others	98.84	18.48	101.35	18.89	82.90	13.70	86.41	10.16
	Total	534.74	100	536.65	100	604.90	100	850.66	100

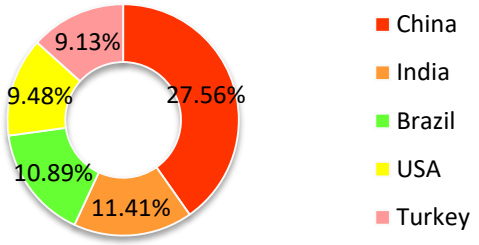
Source: UN Comtrade

World's top Exporters of Quart (other than natural sand) from 2018-2021**(in million USD)**

Data label given on the basis of 2021



Country wise world's top 5 exporter of Quart (other than natural sand) by percentage in 2021 :



In 2021, world export of Quart (other than natural sand) was US $ 850.66 million. In that year the global exports of Quartz (other than natural sand) increased from US $ 604.90 million in 2020 to US $ 850.66 million. China was the largest exporter of Quartz (other than natural sand) in the world, exported US $ 234.48 million or accounted 27.56 % of the global export in 2021, **India** stood at 2nd position in ranking among the world leading exporting countries with US $ 97.25 million or 11.41 % share of global export. Which was followed by Brazil with 10.89% share in 2021.During the review period it is shown that India was the largest exporter of Quart (other than natural sand) in the world for two consecutive years i.e. 2018 and 2019.

Table-3

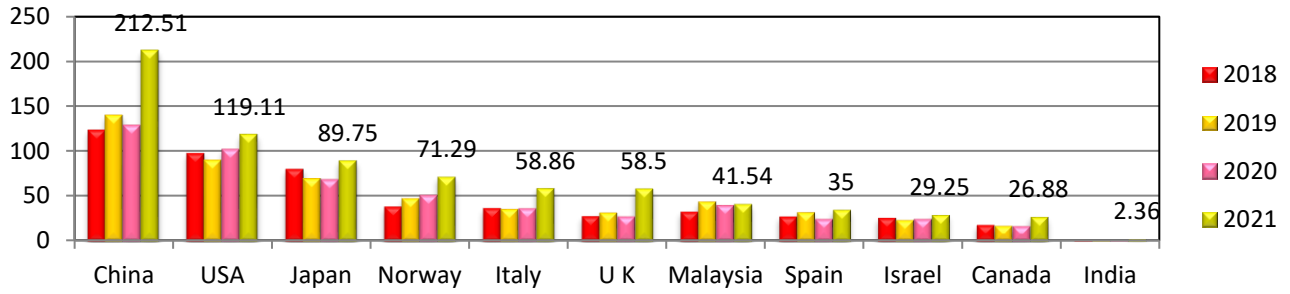
World's top 10 Importers of Quartz(Other than natural Sand) (H.S Code-2506)

Rank	Countries	2018		2019		2020		2021	
		Value (million $)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	China	123.26	17.24	139.56	19.24	127.89	17.77	212.51	22.96
2.	USA	97.52	13.64	90.00	12.41	101.60	14.12	119.11	12.87
3.	Japan	79.97	11.18	69.48	9.58	68.13	9.47	89.75	9.70
4.	Norway	38.35	5.36	47.47	6.55	50.96	7.08	71.29	7.70
5.	Italy	36.71	5.13	35.82	4.94	36.54	5.08	58.86	6.36
6.	U K	27.80	3.89	31.58	4.35	27.48	3.82	58.50	6.32
7.	Malaysia	32.82	4.59	43.85	6.05	39.89	5.54	41.54	4.49
8.	Spain	27.53	3.85	31.96	4.41	24.60	3.42	35.00	3.78
9.	Israel	25.93	3.63	23.31	3.21	24.39	3.39	29.25	3.16
10.	Canada	18.12	2.53	16.88	2.33	16.53	2.30	26.88	2.90
31.	**India**	**0.77**	**0.11**	**0.49**	**0.07**	**0.65**	**0.09**	**2.36**	**0.25**
	Others	206.24	28.84	194.79	26.86	200.92	27.92	180.47	19.50
	Total	715.02	100	725.18	100	719.57	100	925.51	100

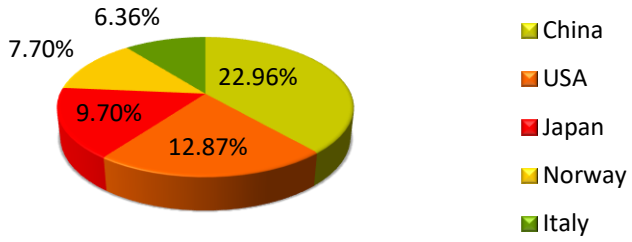
Source : UN Comtrade

Leading Quartz(other than natural sand) importers of world from 2018-2021**(in million USD)**

Data label given on the basis of 2021



Country wise world's top 3 importers of Quartz(other than natural sand) by percentage in 2021

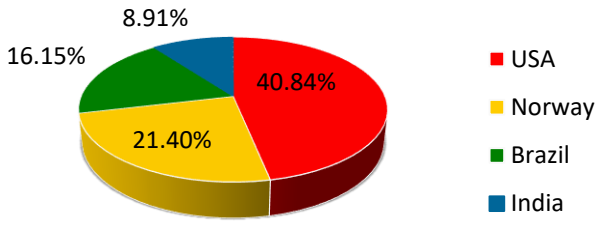


In 2021 Quartz(other than natural sand) imported by China with imports valued at approximately US $ 212.51 million, accounted for 22.96 % of world import value of it and stood at top importer in the world . USA ranked in second that year, with a share of 12.87% of global import. Japan ranked in 3rd in the world in the same year, with 9.70% share globally. India ranked in 31st position in the world with the share of only 0.25% of total Global import value of Quartz (other than natural sand) in that year. It is noticeable that China was the largest importer of Quartz (other than natural sand) as well as the largest exporter of the commodity also.

Annexure-1

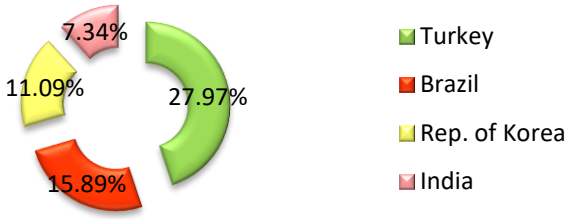
Sources of world's top 3 importers of Quartz(other than natural sand) (H.S Code-2506)

i)Top 3 Sources of Quartz(other than natural sand) to China in 2021 by percentage:



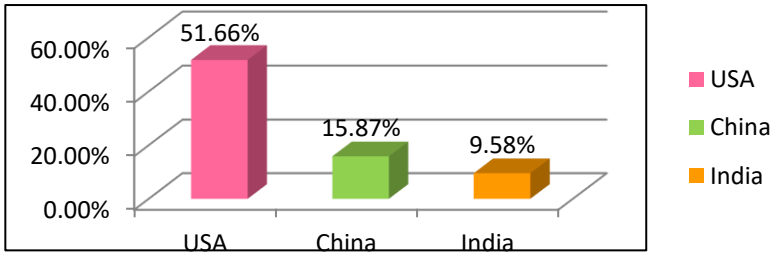
China imported most of its Quartz(other than natural sand) from USA, 40.84% share of China's total import value of Quartz(other than natural sand) came from USA in 2021, 21.40% share came from Norway and 16.15% from Brazil. India also a big source of Quartz(other than natural sand) to China, In the same year China imported 8.91% share of its total import of Quartz(other than natural sand) from **India.(Source : UN Comtrade)**

ii)Top 3 Sources of Quartz(other than natural sand) to USA in 2021 by percentage***:***



USA imports most of its requirements of Quartz(other than natural sand) from Turkey (27.97 %) ,from Brazil (15.89%) ,from Rep. Korea (11.09%) and from **India**'s share was 7.34% in 2021**.(.Source : UN Comtrade)**

iii) Top 3 Sources of Quartz (other than natural sand) to Japan in 2021 by percentage***:***



In the 2021 USA was the largest source country of Quartz (other than natural sand) to Japan. USA exports 51.66% of the Quartz(other than natural sand) to Japan in 2021, It was followed by China (15.87%). In the same year **India** has exported 9.58% share Japan's total import of Quartz(other than natural sand) to Japan. **(Source: UN Comtrade)**

Maize (Corn)

Maize also known as **corn** is a cereal grain first domesticated by indigenous peoples in southern Mexico about 10,000 years ago. The leafy stalk of the plant produces pollen inflorescences (or "tassels") and separate ovuliferous inflorescences called ears that when fertilized yield kernels or seeds, which are fruits. The term *maize* is preferred in formal, scientific, and international usage as a common name because it refers specifically to this one grain, unlike *corn*, which has a complex variety of meanings that vary by context and geographic region.

Maize has become a staple food in many parts of the world, with the total production of maize surpassing that of wheat or rice. In addition to being consumed directly by, maize is also used for corn ethanol, animal feed and other maize products, such as corn starch and corn syrup. The six major types of maize are dent corn, flint corn, pod corn, popcorn, flour corn, and sweet corn. Sugar-rich varieties called sweet corn are usually grown for human consumption as kernels, while field corn varieties are used for animal feed, various corn-based human food uses (including grinding into cornmeal or masa, pressing into corn oil, fermentation and distillation into alcoholic beverages like bourbon whiskey), and as feedstocks for the chemical industry. Maize is also used in making ethanol and other biofuels.

Maize is widely cultivated throughout the world, and a greater weight of maize is produced each year than any other grain. In 2021, total world production was 1.2 billion tonnes. Maize is the most widely grown grain crop throughout the Americas, with 384 million metric tons grown in the United States alone in 2021. Genetically modified maize made up 85% of the maize planted in the United States in 2009. Subsidies in the United States help to account for its high level of cultivation of maize and its position as the largest producer in the world.

Because it is cold-intolerant, in the temperate zones maize must be planted in the spring. Its root system is generally shallow, so the plant is dependent on soil moisture. As a plant that uses C4 carbon fixation, maize is a considerably more water-efficient crop than plants that use C3 carbon fixation such as alfalfa and soybeans. Maize is most sensitive to drought at the time of silk emergence, when the flowers are ready for pollination. In the United States, a good harvest was traditionally predicted if the maize was "knee-high by the Fourth of July", although modern hybrids generally exceed this growth rate. Maize used for silage is harvested while the plant is green and the fruit immature. Sweet corn is harvested in the "milk stage", after pollination but before starch has formed, between late summer and early to mid-autumn. Field maize is left in the field until very late in the autumn to thoroughly dry the grain, and may, in fact, sometimes not be harvested until winter or even early spring. The importance of sufficient soil moisture is shown in many parts of Africa, where periodic drought regularly causes maize crop failure and consequent famine. Although it is grown mainly in wet, hot climates, it has been said to thrive in cold, hot, dry or wet conditions, meaning that it is an extremely versatile crop.

Corn is one of the world's most productive and dominant crops. It is grown extensively as food for both humans and livestock, as a biofuel, and as a crude material in industry.

Corn is the third largest plant-based food source in the world. Despite its importance as a major food in many parts of the world, corn is inferior to other cereals in nutritional value. Its protein is of poor quality, and it is deficient in niacin. Diets in which it predominates often result in pellagra (niacin-deficiency disease). Corn is high in dietary fibre and rich in antioxidants.

Maize is widely cultivated throughout the world, and a greater weight of maize is produced each year than any other grain. In 2020, total world production was 1.16 billion tonnes, led by the United States with 31.0% of the total (table). China produced 22.4% of the global total.

These are broadly classified under **H.S. Code-1005**

Table - 4

India's Top 10 destination of Maize ((HS Code –1005)

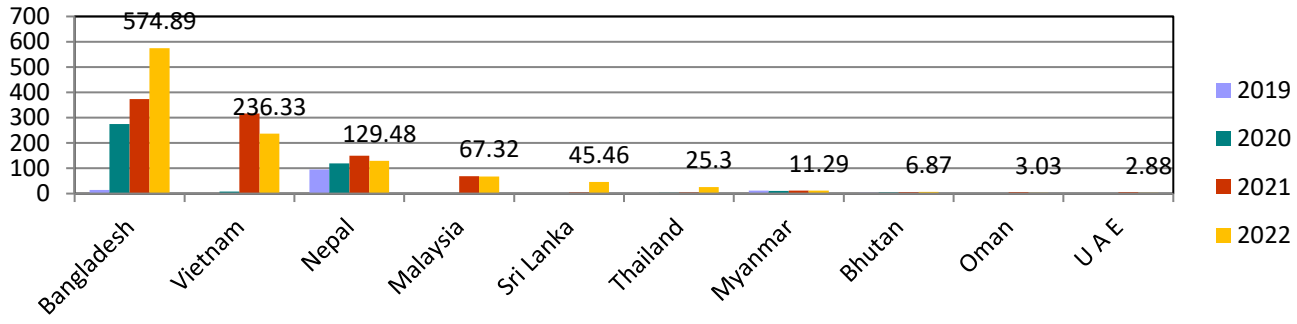
Rank	Countries	2019		2020		2021		2022	
		Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	Bangladesh	14.75	9.92	274.33	63.76	373.36	38.52	574.89	51.26
2.	Vietnam	1.26	0.85	8.47	1.97	317.09	32.72	236.33	21.07
3.	Nepal	95.38	64.13	118.72	27.59	150.20	15.50	129.48	11.55
4.	Malaysia	0.08	0.06	1.80	0.42	69.18	7.14	67.32	6.00
5.	Sri Lanka	0.26	0.18	0.01	0.00	4.34	0.45	45.46	4.05
6.	Thailand	1.94	1.30	2.63	0.61	3.90	0.40	25.30	2.26
7.	Myanmar	11.14	7.49	10.64	2.47	11.34	1.17	11.29	1.01
8.	Bhutan	3.09	2.08	3.80	0.88	5.72	0.59	6.87	0.61
9.	Oman	1.02	0.69	1.24	0.29	6.02	0.62	3.03	0.27
10.	U A E	0.71	0.48	0.53	0.12	5.48	0.57	2.88	0.26
	Others	19.09	12.84	8.09	1.88	22.59	2.33	18.61	1.66
	Total	148.72	100	430.26	100	969.21	100	1121.46	100

Source: DGCI&S

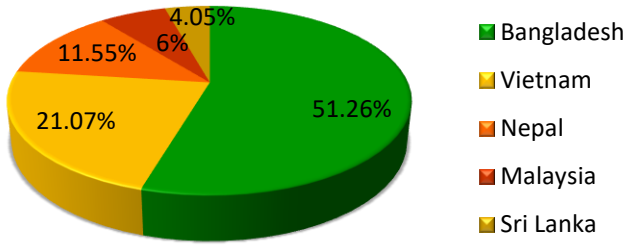
Note : India's Export including re-export

India's major destination Maize (corn) from 2019-2022**(Values in million USD)**

Data label given on the basis of 2022



India's top 5 destinations of Maize (corn) by percentage in 2022:



India's Maize exports hit all-time high of US $ 1.12 billion in 2022. The export of Maize increased more than 15.70% in the year 2021. Bangladesh, Vietnam and Nepal were the major importers of Maize from India. Bangladesh has imported worth US $ 574.89 million in 2021, while Vietnam and Nepal has imported Maize worth US $ 236.33 Million and US $ 129.48 Million respectively during the year 2022. Other prominent importing countries were Thailand, Myanmar, Bhutan, Oman and UAE etc. The top three country has imported 83.88 % of India's total export value of in 2022.

Table - 5

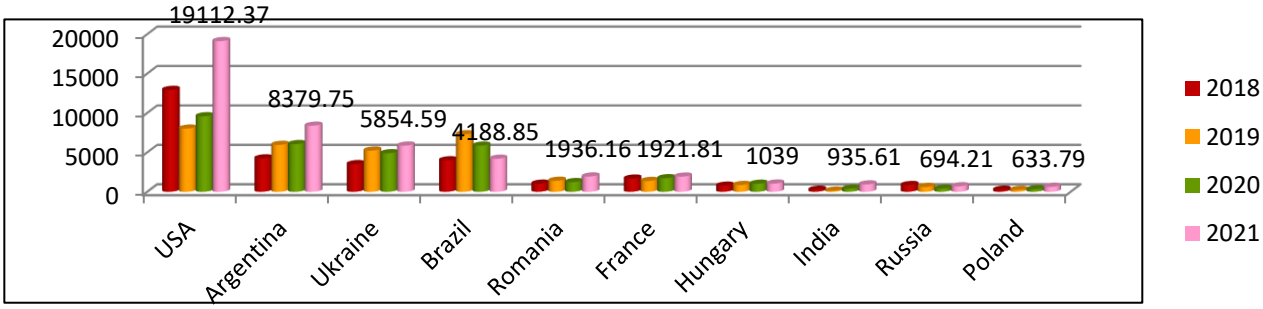
World's Top 10 exporters of Maize (Corn) ((HS Code –1005)

Rank	Countries	2018		2019		2020		2021	
		Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	USA	12920.88	38.22	8013.01	22.48	9575.25	26.08	19112.37	38.32
2.	Argentina	4233.79	12.52	5948.63	16.69	6046.74	16.47	8379.75	16.80
3.	Ukraine	3506.06	10.37	5218.28	14.64	4885.13	13.30	5854.59	11.74
4.	Brazil	3993.65	11.81	7289.55	20.45	5853.00	15.94	4188.85	8.40
5.	Romania	1026.60	3.04	1390.73	3.90	1225.77	3.34	1936.16	3.88
6.	France	1666.74	4.93	1371.72	3.85	1717.21	4.68	1921.81	3.85
7.	Hungary	771.32	2.28	860.30	2.41	1015.88	2.77	1039.00	2.08
8.	**India**	**254.16**	**0.75**	**143.86**	**0.40**	**389.28**	**1.06**	**935.61**	**1.88**
9.	Russia	853.08	2.52	617.63	1.73	395.24	1.08	694.21	1.39
10.	Poland	257.23	0.76	240.59	0.68	322.18	0.88	633.79	1.27
	Others	4319.79	12.78	4545.70	12.75	5295.43	14.42	5173.95	10.37
	Total	33803.31	100	35639.99	100	36721.12	100	49870.08	100

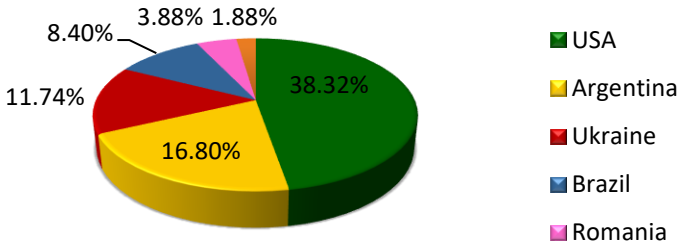
Source: UN Comtrade

Top world exporters of Maize (corn) from 2018 to 2021 **(Values in million USD)**

Data label given on the basis of 2021



Export trends in world's leading Maize (corn) exporters by percentage in 2021:



The USA was the top country by Maize exports value in the world. As of1, Maize exports worth value in the USA was US $ 19.11 Billion, accounts for 38.32% of the world's exports value. Argentina and Ukraine were stood at 2nd and 3rd position in ranking in world export of it with worth value of US $ 8.37 Billion and US $ 5.85 Billion respectively. Other major exporting countries of Maize in 2021 were Brazil, France and Romania. India's position in world's export of Maize was 8th rank with 1.88% share.

Table - 6

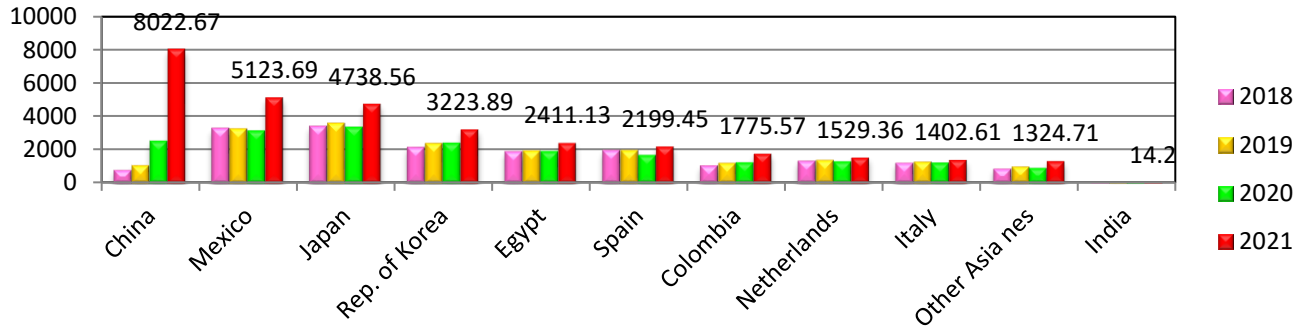
World's Top 10 Importers of Maize (Corn) ((HS Code –1005)

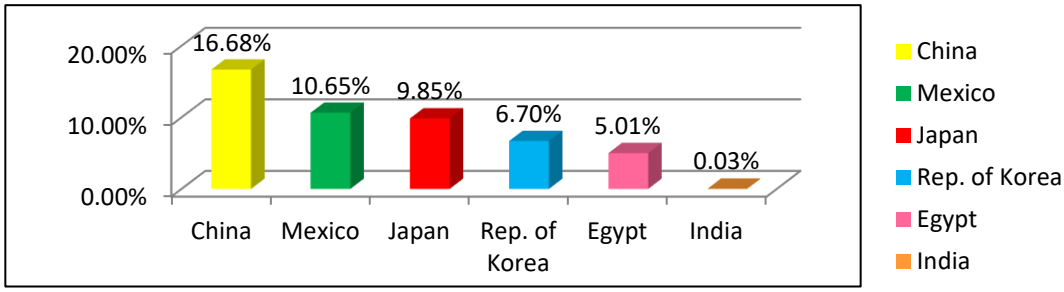
Rank	Countries	2018		2019		2020		2021	
		Value (million $)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	China	787.19	2.18	1061.15	2.94	2481.09	6.88	8022.67	16.68
2.	Mexico	3253.33	9.02	3190.08	8.85	3089.72	8.57	5123.69	10.65
3.	Japan	3368.53	9.34	3523.84	9.78	3293.21	9.14	4738.56	9.85
4.	Rep. of Korea	2132.57	5.91	2352.95	6.53	2370.92	6.58	3223.89	6.70
5.	Egypt	1882.70	5.22	1929.76	5.35	1880.86	5.22	2411.13	5.01
6.	Spain	1968.48	5.46	1945.69	5.40	1653.44	4.59	2199.45	4.57
7.	Colombia	1049.97	2.91	1190.54	3.30	1221.51	3.39	1775.57	3.69
8.	Netherlands	1317.53	3.65	1355.23	3.76	1289.97	3.58	1529.36	3.18
9.	Italy	1204.96	3.34	1261.23	3.50	1214.33	3.37	1402.61	2.92
10.	Other Asia nes	854.48	2.37	979.56	2.72	889.34	2.47	1324.71	2.75
81.	**India**	**15.51**	**0.04**	**76.45**	**0.21**	**64.70**	**0.18**	**14.20**	**0.03**
	Others	18236.00	50.56	17182.89	47.66	16598.69	46.05	16324.92	33.95
	Total	36071.24	100	36049.38	100	36047.79	100	48090.77	100

Source :UNComtrade

Top world importers of Maize (corn) from 2018 to 2021**(Values in million USD)**

Data label given on the basis of 2021



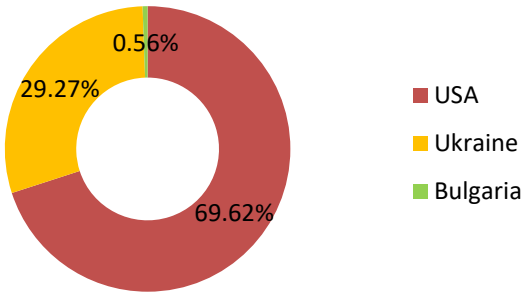


Top importers of Maize, China was the largest Maize-importing nation. Its import worth value of was US $ 8.02 billion in 2021, accounted 16.68% share of world import value of Maize. The Mexico, Japan Rep of Korea and Egypt were other major importing countries of Maize in 2021. Collectively, these five major countries represent more than 48.89% of globally import of Maize during 2021. In the same year India imported 0.03% share of Maize.

Annexure-II

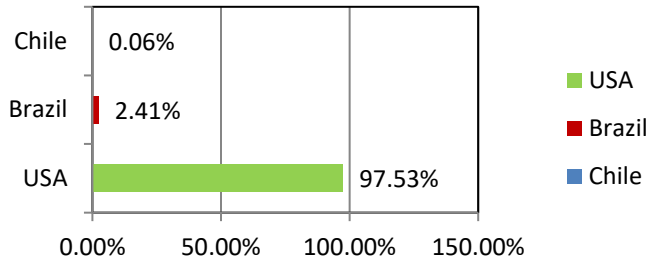
Sources of world's top three importers of Maize (Corn) ((HS Code –1005)

i) Top 3 Sources of Maize (Corn) to China in 2021 by percentage**:**



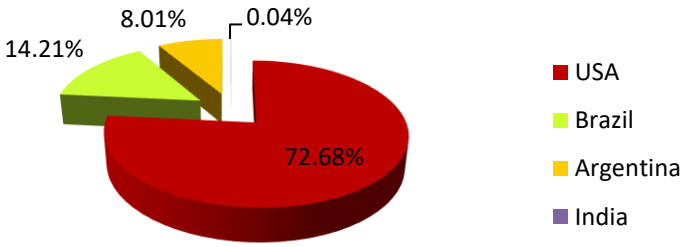
USA is the main source of Maize to China, China exported 69.62% share of USA'S import of Maize in 2021. Ukraine and Bulgaria are found to be the 2nd and 3rd largest exporters of Maize to China by 29.27% and 0.56% shares of China's total import respectively in 2021. **(Source: UN Comtrade)**

(ii) Top 3 Sources of Maize (Corn) to Mexico in 2021 by percentage**:**



97.53% share of Maize imports to Mexico came from USA in 2021, it was distantly followed by Brazil (2.41%) and Chile (0.06%). India had no share to Mexico in that year. **Source: UN Comtrade)**

(iii) Top 3 Sources of Maize to Japan in 2020 by percentage**:**



With 72.68% share of Japan's total import of Maize , USA became the largest source of it to Japan in 2021. Brazil (14.21 %) and Argentina (8.01%) were 2nd and 3rd major sources of Maize to Japan in that year. India's share was only 0.04% share of Japan's total import in 2021. **(Source : UN Comtrade)**

IMPORT

Nitrile-Function Compound

Nitrile is any organic compound that has a −C≡N functional group. The prefix cyano- is used interchangeably with the term *nitrile* in industrial literature. Nitriles are found in many useful compounds, including methyl cyanoacrylate, used in super glue, and nitrile rubber, a nitrile-containing polymer used in latex-free laboratory and medical gloves. Nitrile rubber is also widely used as automotive and other seals since it is resistant to fuels and oils. Organic compounds containing multiple nitrile groups are known as cyan carbons.

Inorganic compounds containing the −C≡N group are not called nitriles, but cyanides instead. Though both nitriles and cyanides can be derived from cyanide salts, most nitriles are not nearly as toxic. The first compound of the homolog row of nitriles, the nitrile of formic acid, hydrogen cyanide was first synthesized by C. W. Scheele in 1782. In 1811 J. L. Gay-Lussac was able to prepare the very toxic and volatile pure acid. Around 1832 benzo nitrile, the nitrile of benzoic acid, was prepared by Friedrich Wohler and Justus von Liebig, but due to minimal yield of the synthesis neither physical nor chemical properties were determined nor a structure suggested. In 1834 Théophile-Jules Pelouze synthesized propionitrile, suggesting it to be an ether of propionic alcohol and hydrocyanic acid. The synthesis of benzo nitrile by Hermann Fehling in 1844 by heating ammonium benzoate was the first method yielding enough of the substance for chemical research. Fehling determined the structure by comparing his results to the already known synthesis of hydrogen cyanide by heating ammonium formate. He coined the name "nitrile" for the newfound substance, which became the name for this group of compounds.

Nitrile groups in organic compounds can undergo a variety of reactions depending on the reactants or conditions. A nitrile group can be hydrolyzed, reduced, or ejected from a molecule as a cyanide ion.

Nitriles are precursors to transition metal nitrile complexes, which are reagents and catalysts. Examples include tetrakis(acetonitrile)copper(I) hexafluorophosphate ($[Cu(MeCN)_4]^+$) and bis(benzo nitrile)palladium dichloride ($PdCl_2(PhCN)_2$)

Nitriles occur naturally in a diverse set of plant and animal sources. Over 120 naturally occurring nitriles have been isolated from terrestrial and marine sources. Nitriles are commonly encountered in fruit pits, especially almonds, and during cooking of *Brassica* crops (such as cabbage, Brussels sprouts, and cauliflower), which release nitriles through hydrolysis. Mandelonitrile, a cyanohydrin produced by ingesting almonds or some fruit pits, releases hydrogen cyanide and is responsible for the toxicity of cyanogenic glycosides.

Over 30 nitrile-containing pharmaceuticals are currently marketed for a diverse variety of medicinal indications with more than 20 additional nitrile-containing leads in clinical development. The nitrile group is quite robust and, in most cases, is not readily metabolized but passes through the body unchanged. The types of pharmaceuticals containing nitriles are diverse, from vildagliptin, an antidiabetic drug, to anastrozole, which is the gold standard in treating breast cancer. In many instances the nitrile mimics functionality present in substrates for enzymes, whereas in other cases the nitrile increases water solubility or decreases susceptibility to oxidative metabolism in the liver. The nitrile functional group is found in several drugs.

These are broadly classified under **H. S. Code 2926**.

Table - 7

India's Top 10 Sources of Nitrile - Function Compounds (HS Code :2926)

Rank	Countries	2019		2020		2021		2022	
		Value (million $)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	China	262.89	45.09	266.20	52.92	421.55	57.46	437.20	58.12
2.	Taiwan	22.02	3.78	23.19	4.61	46.40	6.32	100.11	13.31
3.	Korea RP	75.86	13.01	41.00	8.15	82.34	11.22	98.27	13.06
4.	U S A	63.15	10.83	40.12	7.97	39.78	5.42	29.88	3.97
5.	Netherland	29.22	5.01	39.52	7.86	23.61	3.22	16.96	2.25
6.	Germany	11.44	1.96	13.88	2.76	22.99	3.13	14.95	1.99
7.	Sweden	0.84	0.14	1.65	0.33	3.13	0.43	9.14	1.22
8.	Latvia	42.36	7.26	24.60	4.89	1.68	0.23	8.97	1.19
9.	Brazil	19.32	3.31	15.47	3.07	27.16	3.70	7.38	0.98
10.	Belgium	10.67	1.83	17.00	3.38	39.82	5.43	4.90	0.65
	Others	45.30	7.77	20.41	4.06	25.19	3.43	24.43	3.25
	Total	583.07	100	503.03	100	733.65	100	752.18	100

Source: DGCI&S

Note : India's Import including re-import

There was a total of 53 countries India imports Nitrile-Function Compound. Nitrile-Function Compound import to India in 2022 stood at US $ 752.18 Million which was more than 2.52% more from the year 2021. Major three source countries of Nitrile-Function Compound to India in 2022 were China (US $ 437.20 Million), Taiwan (US $ 100.11 Million) and Korea RP (US $ 98.27 Million). These 3 countries in total sold US $ 635.58 Million value of Nitrile-Function Compound to India which was 84.49% of India's total import in 2022.

Table - 8

World Top 10 Importer of Nitrile - Function Compounds (HS Code :2926)

Rank	Countries	2018		2019		2020		2021	
		Value (million $)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	China	1393.91	22.68	1264.16	22.09	991.57	19.23	1143.02	16.93
2.	**India**	**612.82**	**9.97**	**583.55**	**10.19**	**504.00**	**9.78**	**735.44**	**10.90**
3.	Rep of Korea	382.00	6.22	316.09	5.52	258.12	5.01	517.64	7.67
4.	Italy	66.25	1.08	61.92	1.08	327.43	6.35	433.02	6.42
5.	Brazil	212.73	3.46	281.28	4.91	350.38	6.80	404.44	5.99
6.	Netherlands	159.98	2.60	168.96	2.95	180.56	3.50	397.53	5.89
7.	USA	353.22	5.75	366.21	6.40	345.60	6.70	390.64	5.79
8.	France	316.21	5.14	355.40	6.21	289.06	5.61	346.06	5.13
9.	Malaysia	290.70	4.73	248.43	4.34	211.58	4.10	311.21	4.61
10.	Germany	281.31	4.58	252.61	4.41	208.81	4.05	273.83	4.06
	Others	2077.15	33.80	1825.41	31.89	1488.66	28.87	1797.01	26.62
	Total	6146.28	100	5724.02	100	5155.79	100	6749.83	100

Source :UNComtrade

Global Import of Nitrile-Function Compound, the top five importers in 2021 were China (US $ 1.14 B), **India** (US $ 735.44 M), Rep. of Korea (US $ 517.64 M), Italy (US $ 433 M) and Brazil (US $ 404.44 M), respectively of world import value of Nitrile-Function Compound. The top five importing country imported 47.91% share of world's total import Nitrile-Function Compounds in 2021. The world import of Nitrile-Function Compound raise up in 2021 by more than 30% compare to that in the year 2020.

Glass Fibre (including Glass Wool)

Glass fibres are formed from melts and manufactured in various compositions by changing the amount of raw materials like sand for silica, clay for alumina, calcite for calcium oxide, and colemanite for boron oxide. Therefore, different types of glass fibers show different performances like alkali resistance or high mechanical properties using various amounts of silica or other sources. Glass fibre products are classified according to the type of composite at which they are utilized. Moreover, chopped strands, direct draw rovings, assembled rovings, and mats are the most important products that are used in the injection moulding, filament winding, pultrusion, sheet moulding, and hand layup processes to form glass fibre-reinforced composites. Protection of the glass fibre filaments from breakage or disintegration is an important issue either during manufacturing of glass fibre or during composite production. Applying sizing agent to the glass fibre during manufacturing of fibers causes lubrication of the glass fibre filaments in addition to inhibit static electricity accumulation, adhesion of the fibre filaments together, and adhesion between fibre filaments and polymer matrix of the composites. During manufacturing of composites, an interphase layer, at which interpenetration of the sizing to the matrix or diffusion of the matrix polymer to the sizing, is formed. The resultant interphase layer can either increase or decrease the performance of the composite considering harmony between sizing components and matrix polymer. Compatibility between sizing and matrix polymer enhances high mechanical properties and on the contrary incompatible sizing results poor mechanical properties. From energy point of view, reduction in the weight of vehicles is the main reason to save energy in the transportation industry, and in this regard growth in the production of lightweight cars to about 50% indicates importance of the glass fibre-reinforced composites. Consequently, growth in the glass fibre production is what that happened and will be continued in the future.

The possibility of obtaining fine glass fibers was known in ancient times even before the technology of blowing glass. Many Egyptian vessels were made by winding glass fibers on a rim of clay of a suitable form.

After the appearance of glass in the first century BC, this technique was used by Venetian glassmakers in the 16th and 17th centuries to decorate the dishes. In this case, the bundles of opaque white fibers were wound on the surface of a transparent vessel, for example, a goblet, and then heated up strongly. Similar decorative effects were achieved in the production of glasses in England. In 1935, the first patents appeared, containing thermosetting resins, which were installed at room temperature, for example, polyesters. These, when reinforced with fiberglass can be used for structural shapes and lead to a strengthened plastics industry. The first important application was the production of radomes for aircraft during the World War II.

Glass fibers are used as reinforcement for plastics materials to increase tensile strength, flex modulus, creep resistance, impact resistance, dimensional stability, heat, and chemical resistance. Often coupling agents such as silanes are used as sizing on glass fibers to improve reinforcing efficiency in plastics. Disadvantage of glass fibers are warpage, low weld, and knit line strength, higher viscosity of melt, and low surface quality and increase in damage to machine and tool due to abrasion.

Glass fibers are available in variety of shapes and forms that includes continuous fibre, rovings, staple fibre and chopped strand. Continuous fibre and chopped strand are more common for mixing with resin and are shown in Fig. 4.3. Although, strength-to-weight ratio of glass fibers is high, but elastic modulus tends to be low thus, these fibre increases stiffness and reduces elongation of plastic composite. Glass fibers are priced much lower than the actual resin and offer cost benefits.

Global Glass Fiber Market Report 2021: Market was Valued at US$14.19 Billion in 2019 and is Projected to be Worth US$19.83 Billion by 2027 (Source-Globe newswire).

These are broadly classified under H. S. Code **7019.**

Table - 9

India's Top 10 Sources of Glass Fibre (HS Code :7019)

Rank	Countries	2019		2020		2021		2022	
		Value (million $)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	China	142.92	52.67	108.22	48.77	164.98	50.77	299.40	66.69
2.	Malaysia	22.10	8.14	21.83	9.84	25.37	7.81	26.15	5.82
3.	U S A	18.88	6.96	18.54	8.36	17.23	5.30	15.28	3.40
4.	Thailand	7.93	2.92	4.76	2.14	4.96	1.53	14.19	3.16
5.	Taiwan	4.15	1.53	3.35	1.51	14.24	4.38	11.61	2.59
6.	Bahrain	7.27	2.68	7.65	3.45	12.57	3.87	11.37	2.53
7.	Germany	6.40	2.36	5.66	2.55	9.61	2.96	11.28	2.51
8.	Spain	4.10	1.51	5.87	2.65	9.66	2.97	7.05	1.57
9.	Korea RP	5.05	1.86	3.44	1.55	5.61	1.73	6.01	1.34
10.	U K	5.81	2.14	5.47	2.47	6.56	2.02	5.79	1.29
	Others	46.73	17.22	37.08	16.71	54.17	16.67	40.80	9.09
	Total	271.35	100	221.89	100	324.95	100	448.94	100

Source: DGCI&S

Note : India's Import including re-import

Glass Fibre (including Glass wool) import in 2022 stood at US $ 448.94 Million and US $ 271.35 Million in 2019, which shows a positive growth of more than 65.68% from the 2019 of India's import value of Glass Fibre (including glass wool). Major three source countries of the commodity to India in 2022 are China (US $ 299.40 Million), Malaysia(US $ 26.15 Million) and USA (US $ 15.28 Million). These 3 countries in total sold US $ 340.83 Million value of glass fibre to India which rounds up to almost 75.91% of the total glass fibre import into India.

Table - 10

World Top 10 Importer of Glass Fibre (HS Code :7019)

Rank	Countries	2018		2019		2020		2021	
		Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)	Value (million$)	Share (%)
1.	USA	1607.53	12.22	1326.19	10.57	1161.60	10.18	1514.01	10.81
2.	Germany	1321.79	10.05	1183.24	9.43	1041.36	9.13	1320.07	9.42
3.	China	931.62	7.08	943.33	7.52	956.93	8.39	1077.65	7.69
4.	France	679.65	5.17	718.52	5.72	614.18	5.38	784.80	5.60
5.	Mexico	541.38	4.11	573.95	4.57	521.67	4.57	638.59	4.56
6.	Rep. of Korea	481.78	3.66	448.06	3.57	466.85	4.09	560.63	4.00
7.	Italy	420.60	3.20	429.71	3.42	377.80	3.31	542.76	3.87
8.	Japan	492.11	3.74	492.82	3.93	455.05	3.99	503.43	3.59
9.	Canada	458.93	3.49	434.42	3.46	387.16	3.39	470.98	3.36
10.	Poland	323.94	2.46	307.50	2.45	306.49	2.69	391.47	2.79
15.	**India**	**299.94**	**2.28**	**271.32**	**2.16**	**222.29**	**1.95**	**325.17**	**2.32**
	Others	5597.76	42.55	5421.97	43.20	4898.92	42.93	5878.69	41.97
	Total	13157.02	100	12551.01	100	11410.30	100	14008.26	100

Source :UNComtrade

The three major importers of Glass Fibre, namely USA, Germany and China represented almost 28% of total imports of Glass Fibre in 2021. In value terms, USA (US $ 1.51 B), Germany (US $ 1.32 B) and China (US $ 1.07 B) constituted the countries with the highest levels of imports in 2021. **India** experienced the highest growth rate of the value of imports, among the main importing countries and ranked in 15th position in the world with 2.32% share of Global import of Glass Fibre (including Glass wool) in 2021.